

## HMC199MS8 MSOP8 DUAL SPDT SWITCH DC - 2.5 GHz

FEBRUARY 2001

v01.0700

### Features

- INTEGRATED DUAL SPDTs
- LOW INSERTION LOSS: <0.5 dB @ 2.0 GHz
- POSITIVE CONTROL: 0/+5V
- ULTRA SMALL MSOP8 PACKAGE: 14.8 mm<sup>2</sup>



### General Description

The HMC199MS8 is a low-cost dual SPDT GaAs “bypass” switch in an 8-lead MSOP package covering DC to 2.5 GHz. This four RF port component integrates two SPDT switches and a through line onto a single IC. The design provides low insertion loss of less than 0.5 dB while switching passive or active external circuit components in and out of the signal path. Port to port isolations are typically 35 to 20 dB. On-chip circuitry enables positive voltage control operation at very low DC currents with control inputs compatible with CMOS and most TTL logic families. Applications include LNA or filter bypass switching and single bit attenuator switching for cellular, PCS, and ISM base stations.

7

SMT SPDT SWITCHES



### Guaranteed Performance $V_{ctl} = 0 / +5 V_{dc}$ , 50 Ohm System, -40 to +85 deg. C

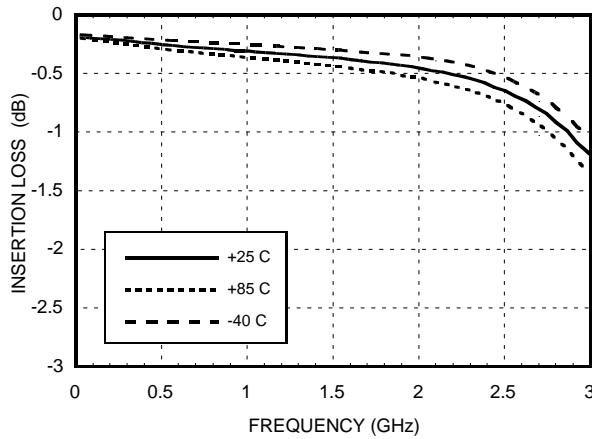
Parameter	Frequency	Min.	Typ.	Max.	Units
Insertion Loss	DC - 1.0 GHz		0.3	0.6	dB
	DC - 2.0 GHz		0.5	0.8	dB
	DC - 2.5 GHz		0.7	1.0	dB
Isolation	DC - 2.0 GHz	22	25		dB
	DC - 2.5 GHz	17	21		dB
Return Loss (On State, Any Port)	DC - 2.0 GHz	22	25		dB
	DC - 2.5 GHz	14	17		dB
Input Power for 1dB Compression	0.5 - 2.0 GHz	19	23		dBm
Input Third Order Intercept (Two Tone Input Power=0 dBm Each Tone)	0.5 - 2.0 GHz	32	36		dBm
Switching Characteristics	DC - 2.5 GHz				
tRISE / tFALL (10/90% RF / 90/10% RF)			20		nS
tON / tOFF (50% CTL to 10/90% RF)			40		nS

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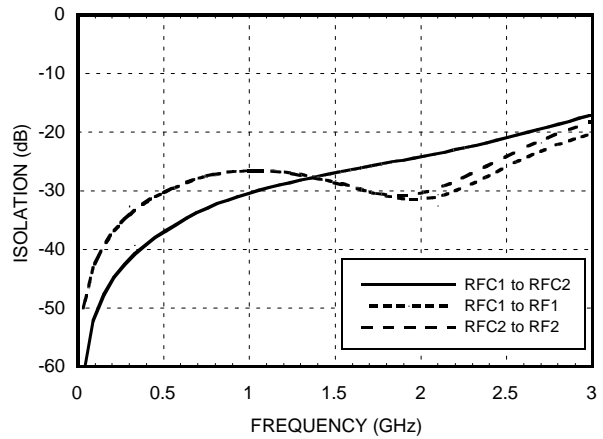
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### Insertion Loss

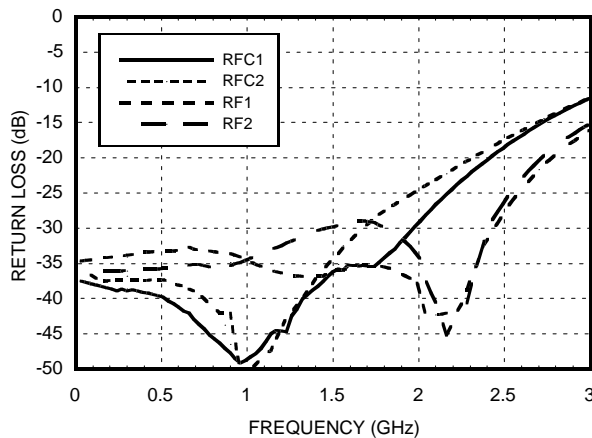


### Isolation



Note: Isolation between RF1 - RF2 (when RFC1 - RFC2 is in insertion loss state) is 25 dB @ 1 GHz and 17 dB @ 2 GHz.

### Return Loss



### Compression vs Frequency

CTL Input (Vdc)	Carrier at 900MHz		Carrier at 1900MHz	
	Input Power for 0.1dB Compression (dBm)	Input Power for 1dB Compression (dBm)	Input Power for 0.1dB Compression (dBm)	Input Power for 1dB Compression (dBm)
+5	20	23.5	19	22

Caution: Do not operate continuously at RF power input greater than 1dB compression and do not "hot switch" power levels greater than +13 dBm (Control =0/ +5Vdc).

### Distortion vs Frequency

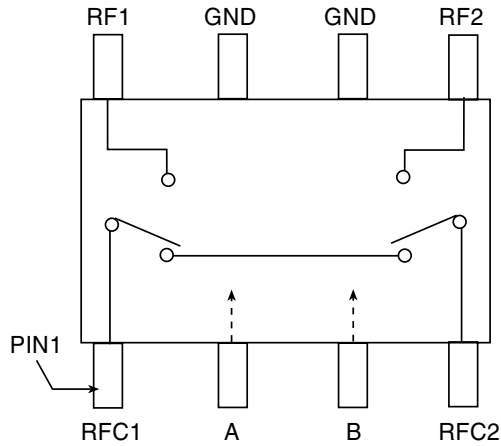
Control Input (Vdc)	Input Third Order Intercept (dBm) 0 dBm Each Tone	
	900 MHz	1900 MHz
+5	34.5	37.5

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### Functional Diagram



### Absolute Maximum Ratings

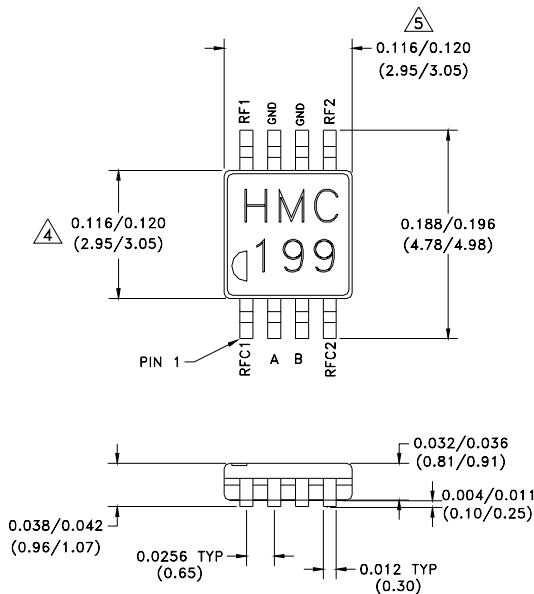
RF Input Power $V_{ctl} = 0/+5V$	+24 dBm
Control Voltage Range (A & B)	-0.5 to +7.5 Vdc
Storage Temperature	-65 to +150 deg C
Operating Temperature	-40 to +85 dec C

### Truth Table

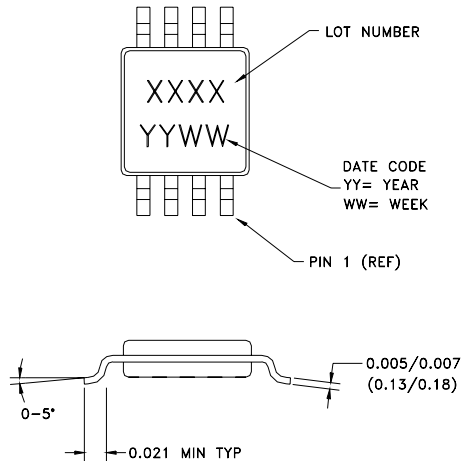
\*Control Input Tolerances are +/- 0.5 Vdc

Control Input *		Control Current (Typical)		Signal Path		
A (Vdc)	B (Vdc)	Ia (uA)	Ib (uA)	RFC1 to RFC2	RFC1 to RF1	RFC2 to RF2
0	+5	-65	65	On	Off	Off
+5	0	65	-65	Off	On	On

### Outline Drawing



DC blocking capacitors are required at ports RFC1, RFC2, RF1, RF2. Choose value for lowest frequency of operation.



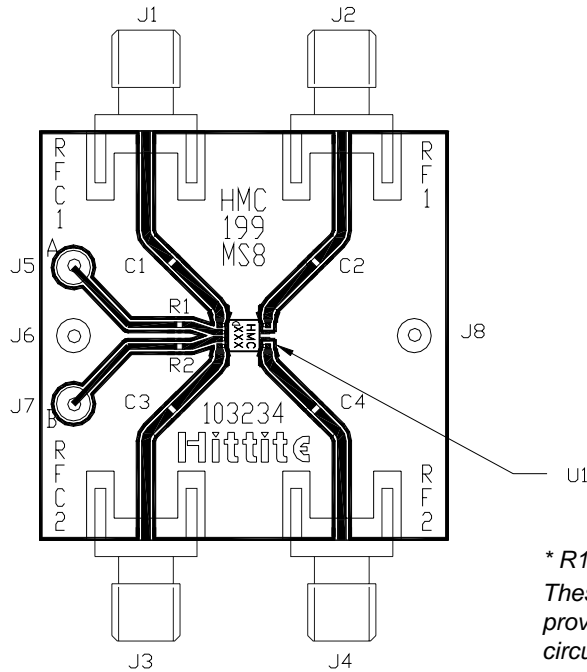
- MATERIAL:
    - A) PACKAGE BODY - LOW STRESS INJECTION-MOLDED PLASTIC.
    - B) LEADFRAME MATERIAL: COPPER ALLOY
  - PLATING: LEAD - TIN SOLDER PLATE
  - DIMENSIONS ARE IN INCHES (MILLIMETERS). UNLESS OTHERWISE SPECIFIED ALL TOL. ARE  $\pm 0.005 (\pm 0.13)$ .
- DIMENSION DOES NOT INCLUDE MOLDFLASH OF 0.15 MM PER SIDE  
 DIMENSION DOES NOT INCLUDE MOLDFLASH OF 0.25 MM PER SIDE

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### ***Eval Board Layout (Top View)***



\*  $R1 \text{ \& } R2 = 100 \Omega$  .  
 These optional resistors will provide more RF path to control circuit isolation.

The circuit board used in the final application should be generated with proper RF circuit design techniques. Signal lines at the RF port should have 50 ohm impedance. The evaluation circuit board shown above is available from Hittite Microwave Corporation upon request.

### ***List of Material***

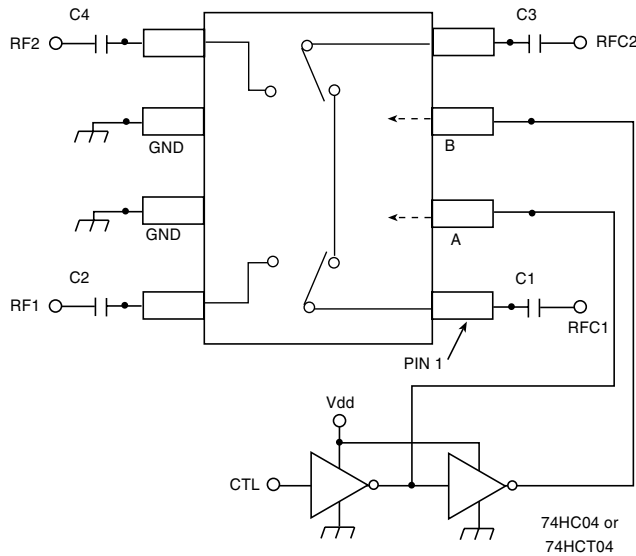
Item	Description
J1 - J4	PC Mount SMA Connector
J5 - J8	DC Pin
C1 - C4	Chip Capacitor, 0402 Pkg. Choose value for lowest frequency of operation. 330 pF is provided on PCB.
R1 - R2	100 ohm Resistor, 0402 Pkg.
U1	HMC199MS8 Bypass Switch
PCB*	103234 Evaluation PCB 1.5" x 1.5"
* Circuit Board Material : Rogers 4350	

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### Typical Application Circuit



**Notes:**

1. Set A / B control to 0/+5V, Vdd = +5V and use HCT series logic to provide a TTL driver interface.
2. Control inputs A/B can be driven directly with CMOS logic (HC) with Vdd = 5 to 7 Volts applied to the CMOS logic gates.
3. DC Blocking capacitors are required for each RF port as shown. Capacitor value determines lowest frequency of operation.
4. Highest RF signal power capability is achieved with Vdd = +7V and A/B set to 0/+7V.

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**NOTES:**